

CBCS SCHEME

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BPHYE102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2025 Applied Physics for EEE Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. VTU Hand Book is permitted.*

Module – 1			M	L	C
Q.1	a.	State and explain Heisenberg's uncertainty principle show that the electron cannot exist inside the nuclear.	8	L2	CO1
	b.	Setup time independent Schrodinger wave equation for free particle in one dimension.	8	L2	CO1
	c.	Calculate the momentum of an electron and de-Broglie wavelength associated with it if its kinetic energy is 1.5 KeV.	4	L3	CO1
OR					
Q.2	a.	What is wave function? Give its physical significance and properties.	8	L2	CO1
	b.	Assuming the time independent Schrodinger's wave equation, discuss the solution for a particle in one dimensional potential well of infinite height and hence obtain the normalized wave function.	8	L2	CO1
	c.	Calculate the energy in eV for the first two permitted excited state of an electron in an infinite potential well of width 2\AA .	4	L3	CO1
Module – 2					
Q.3	a.	What is Fermi's energy? Describe the dependence of Fermi factor on temperature and energy.	8	L2	CO2
	b.	Define internal field. Derive the Clausius – Mossotti equation.	8	L2	CO2
	c.	The Superconducting transition temperature of lead is 7.26 K. The initial field at 0 K is 64×10^3 Amp/m. Calculate the critical field at 5K.	4	L3	CO2
OR					
Q.4	a.	What is Polarization? Describe various types of polarization mechanisms.	8	L2	CO2
	b.	What is Superconductivity? Explain the types of superconductors.	8	L2	CO2
	c.	What is the polarization produced in sodium chloride by an electric field of 600 V/mm, given that its dielectric constant is 6 ?	4	L3	CO2
Module – 3					
Q.5	a.	Derive an expression for the radiant energy density under thermal equilibrium using Einstein's co-efficient.	8	L2	CO1
	b.	Define modes of propagation and V-number. Obtain the expression for the numerical aperture of an optical fiber.	8	L2	CO1

	c.	Find the ratio of population of the two energy states in a material that produces light of wavelength 6328 \AA at 27°C .	4	L3	CO1
OR					
Q.6	a.	Explain the construction and working of carbon dioxide laser. Mention any two applications of it.	8	L2	CO1
	b.	What is Refractive index profile? Describe three types of optical fiber with one application for each type.	8	L2	CO1
	c.	Find the attenuation in an optical fiber of length 500 m when a light signal of power 100 mW emerges out of the fiber with a power 90 mW.	4	L3	CO1
Module – 4					
Q.7	a.	Describe the vector operator ∇ and explain the concepts of divergence, gradient and curl.	8	L2	CO3
	b.	What is displacement current? Derive an expression for displacement current.	8	L2	CO3
	c.	Determine the resonance frequency of an LCR series circuit with inductance = 0.5 henry, capacitance = 0.45, microfarad and resistance = 300Ω	4	L2	CO3
OR					
Q.8	a.	State and prove Gauss divergence theorem. Mention four Maxwell's equations in differential form for time varying fields.	8	L2	CO3
	b.	Derive the wave equation in terms of electric field using Maxwell's equation in free space.	8	L2	CO3
	c.	Find the wavelength of the semiconductor laser in diffraction grating experiment where the angle of diffraction for the first order is 0.75° . Given grating constant = $4.7 \times 10^{-5} \text{ m}^{-1}$.	4	L3	CO5
Module – 5					
Q.9	a.	Show that the Fermi level of an intrinsic semiconductor lies in the mid – part of the forbidden energy gap. Discuss the law of mass action.	8	L2	CO4
	b.	Derive an expression for electrical conductivity of an intrinsic semiconductor.	8	L2	CO4
	c.	The Hall co-efficient of a specimen of a doped silicon is found to be $3.66 \times 10^{-4} \text{ m}^3/\text{C}$. What is the type of charge carriers? Also calculate the carrier concentration.	4	L3	CO4
OR					
Q.10	a.	What is Hall effect? Obtain the expression for Hall voltage and express Hall voltage in terms of Hall coefficient.	8	L2	CO4
	b.	Explain construction and working of semiconductor diode laser with the help of energy Band diagram and mention any two applications of it.	8	L2	CO4
	c.	The resistivity of intrinsic germanium at 27°C is equal to 0.449 ohm-meter . Assuming electron and hole mobilities as $0.39 \text{ m}^2/\text{Volt-Sec}$ and $0.19 \text{ m}^2/\text{Volt-Sec}$ respectively. Calculate the intrinsic carrier density.	4	L3	CO4
